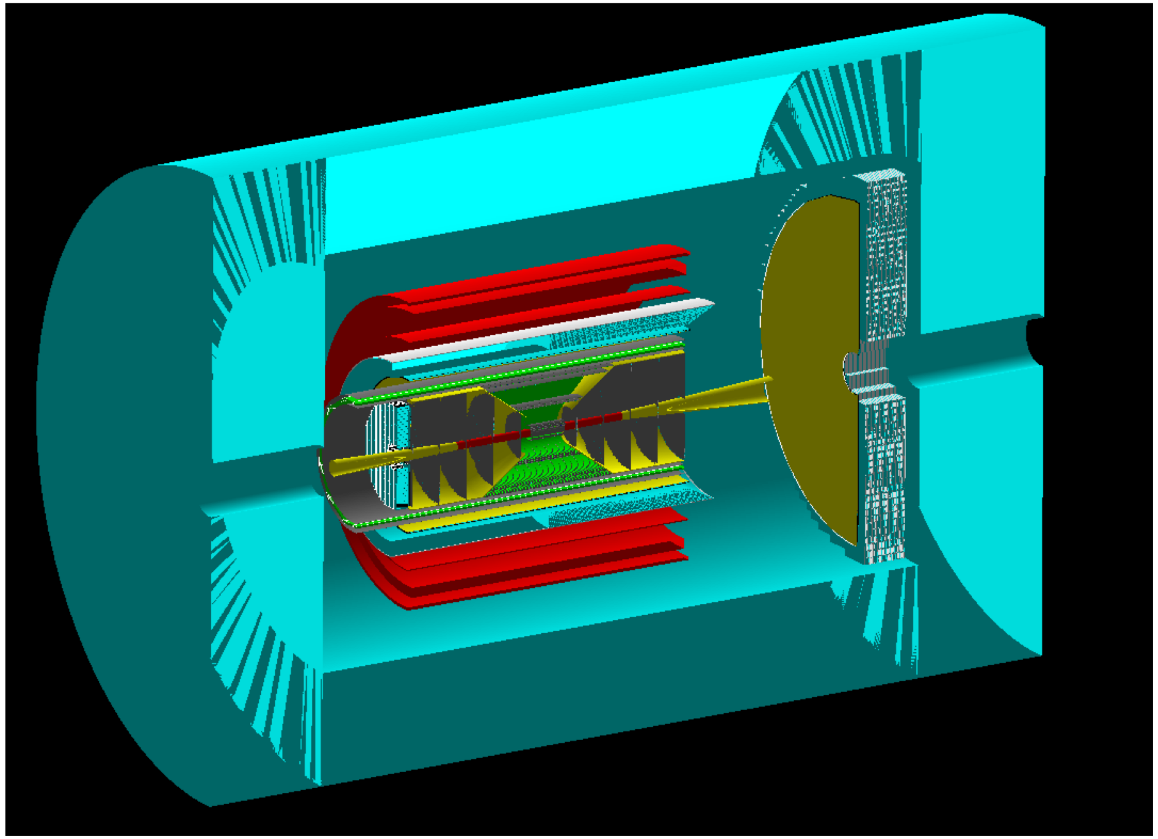
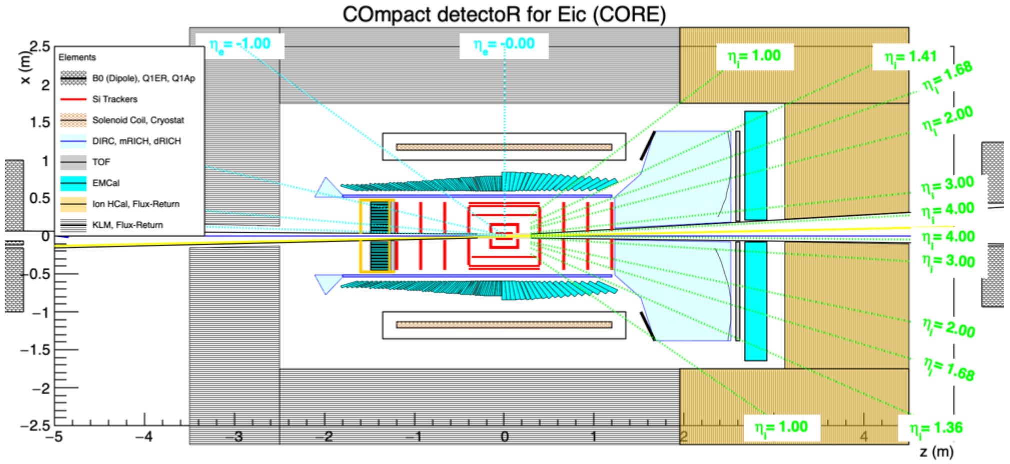
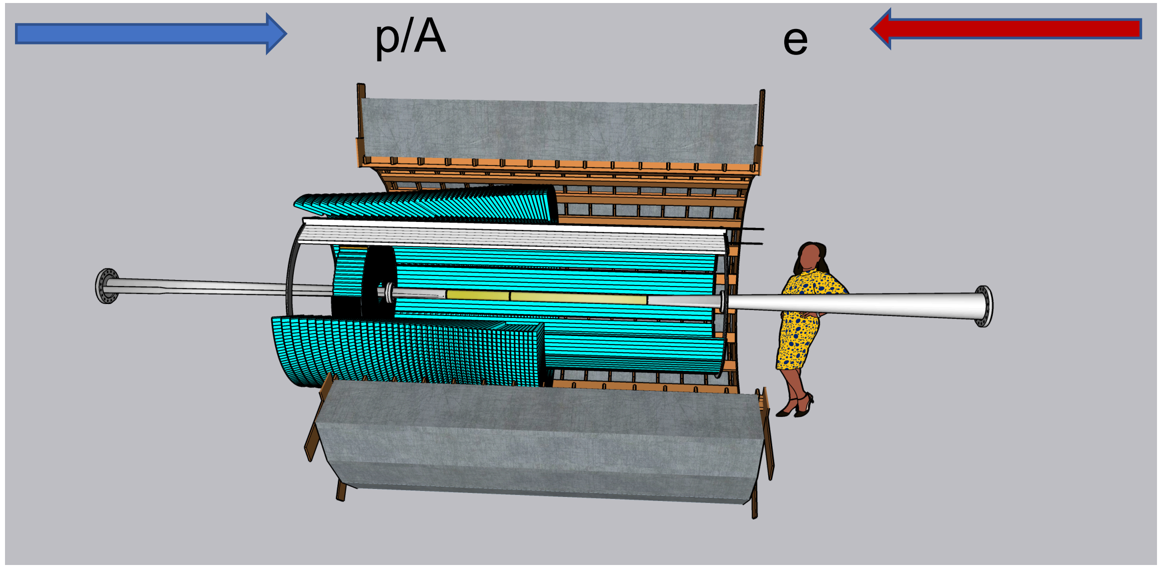
CORE: an overview for physics WG kick-off meeting



WG kick-off meeting, July 15, 2021

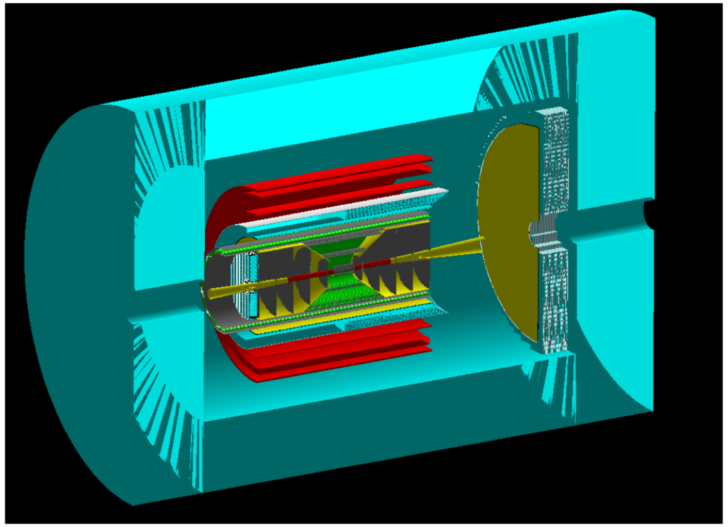
CORE overview



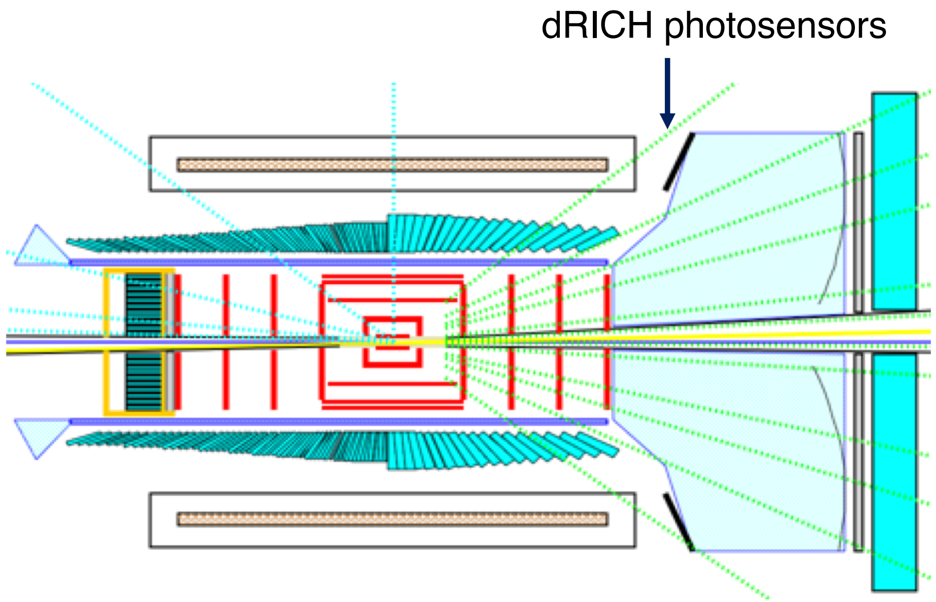


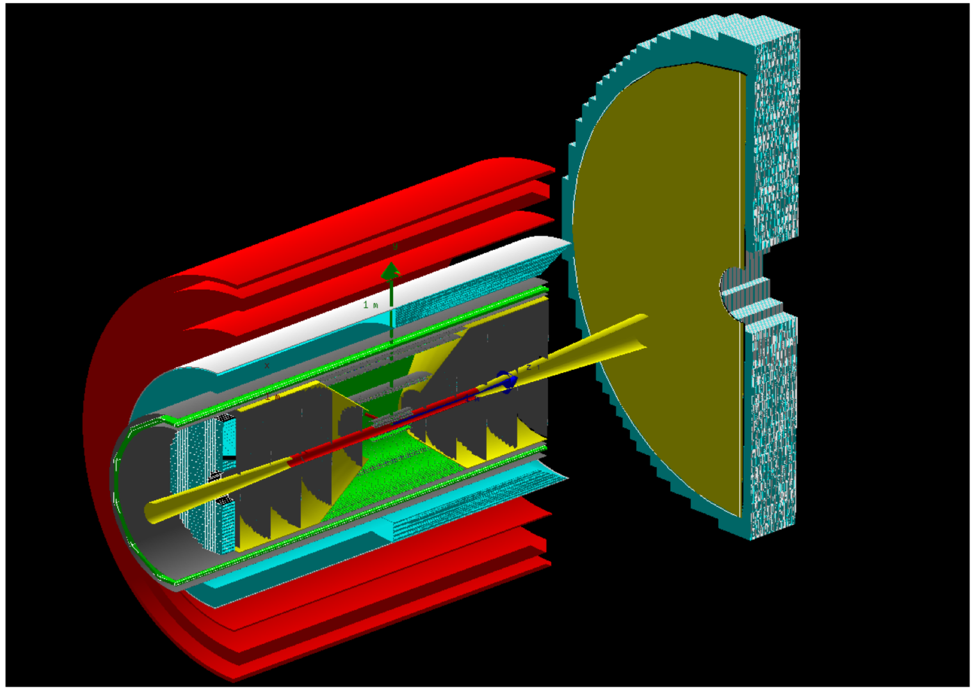
- CORE is a hermetic general-purpose detector that aims to fulfill the EIC physics requirements outlined in the Yellow Report, White Paper, and other documents.
  - Inclusive, semi-inclusive, exclusive, jets, etc.

- CORE is compact (-3.5 m to +4.5 m), which allows
  - a higher luminosity for *all* c.m. energies
  - reduced cost and investment in critical components.



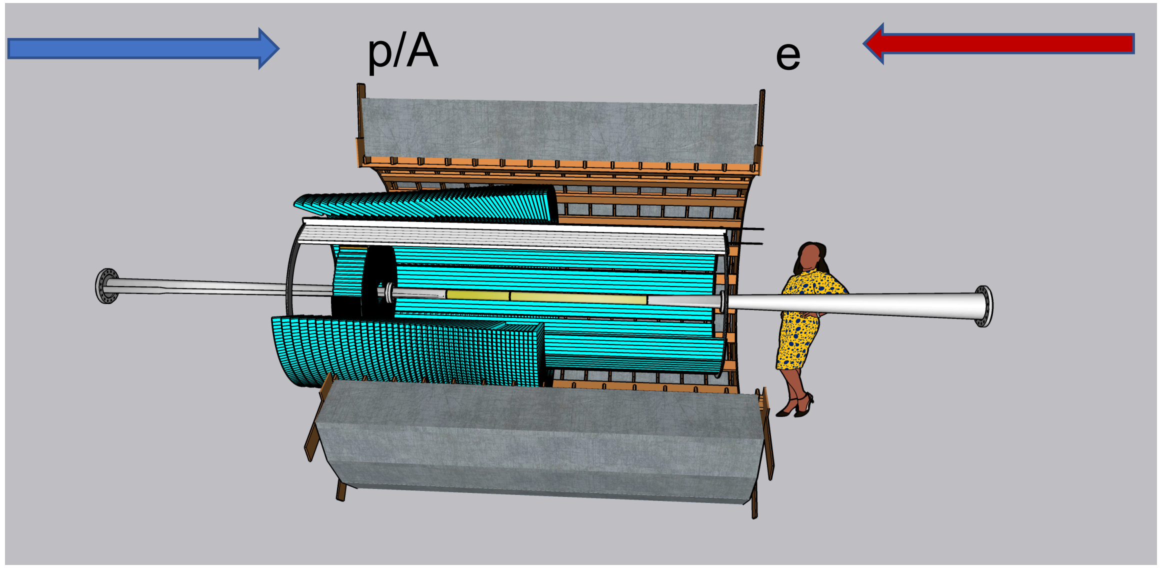
CORE systems

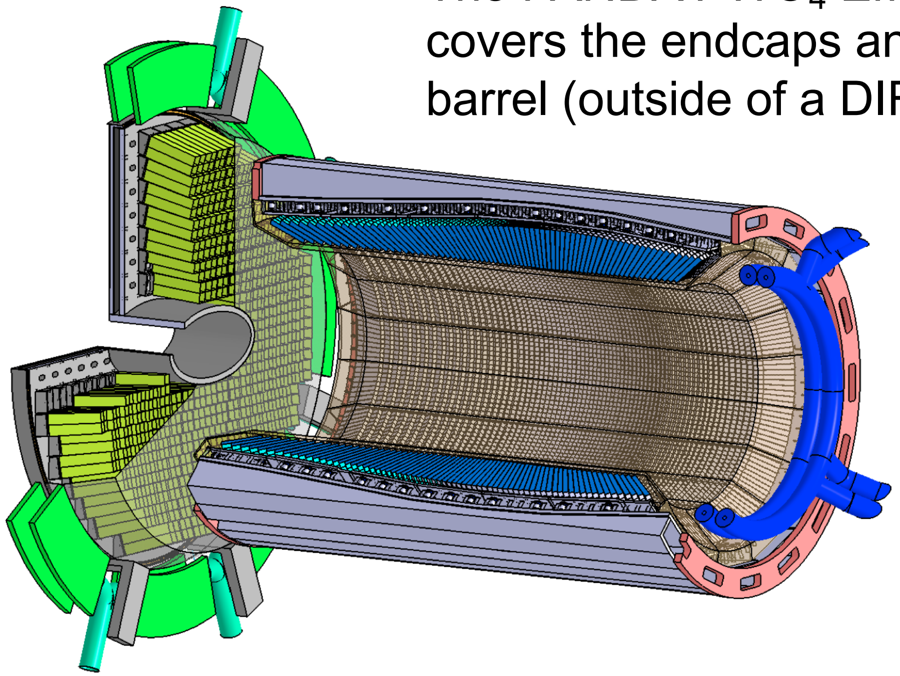




- New 2.5 T solenoid (2.5 m long, 1 m inner radius)
- Tracking: central all-Si tracker (eRD25) and h-endcap GEM tracker (eRD6)
- EMcal (eRD1): PWO for $\eta < 0$ and W-Shashlyk for $\eta > 0$
- Cherenkov PID (eRD14): DIRC (50 cm radius) in barrel and dual-radiator RICH in h-endcap
- TOF: LGADs in e-endcap (eRD29) and a simple TOF behind the dRICH
- Hcal / K_L-μ (KLM) detector integrated with the magnetic flux return

CORE – key features

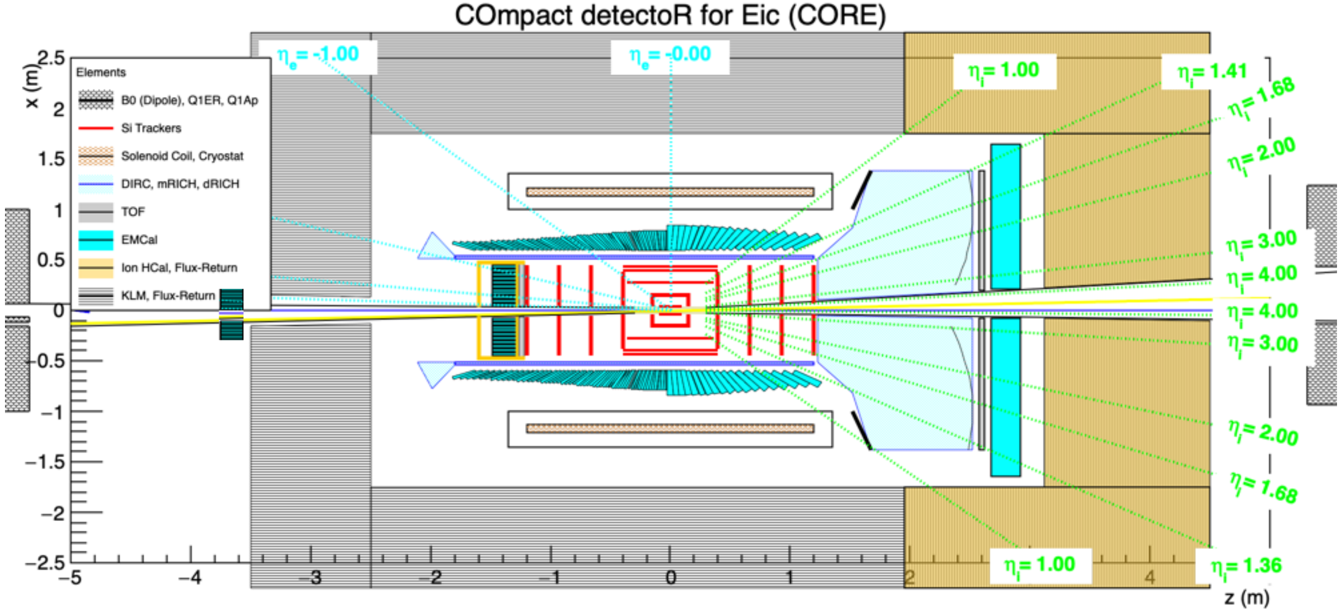




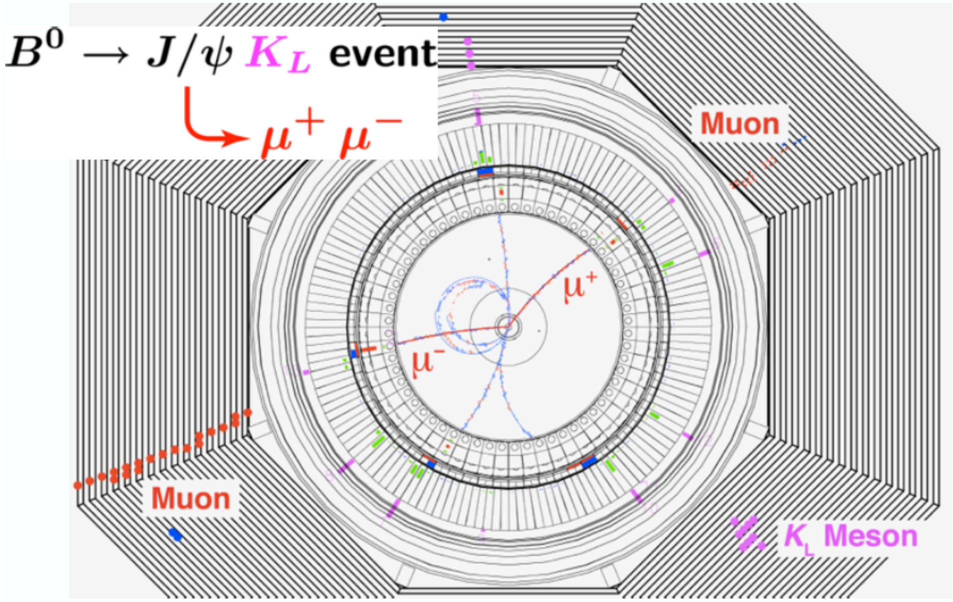
The PANDA PWO_4 EMcal covers the endcaps and barrel (outside of a DIRC)

- Best possible photon detection and electron ID in the (outgoing) electron hemisphere.
  - Photon energy resolution comparable to momentum resolution for charged particles.
- Light e-side endcap with only EM cal and high-resolution TOF
  - Improves hermeticity by reducing need for heavy supports
  - Reduces technical risk related to photosensors for aerogel RICH (B-field and radiation)
- Low-mass, high-performance DIRC for charged hadron ID over a wide range in rapidity
  - Decaying K^0_S detected in Si-tracker – excellent efficiency for all momenta in endcaps

CORE – key features

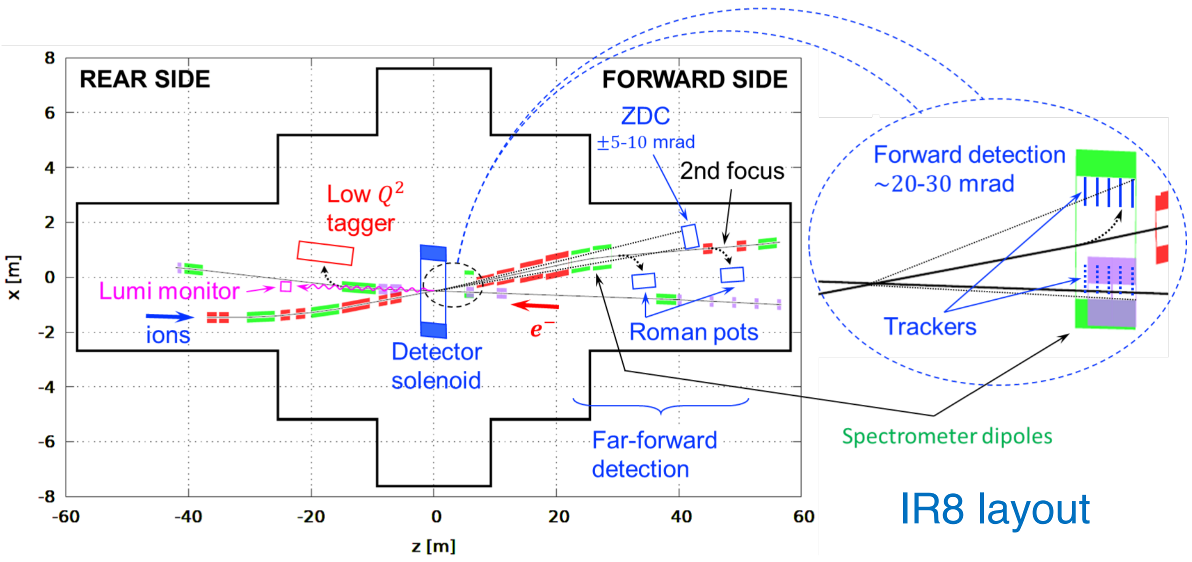


The Belle II K_L-μ (KLM) system



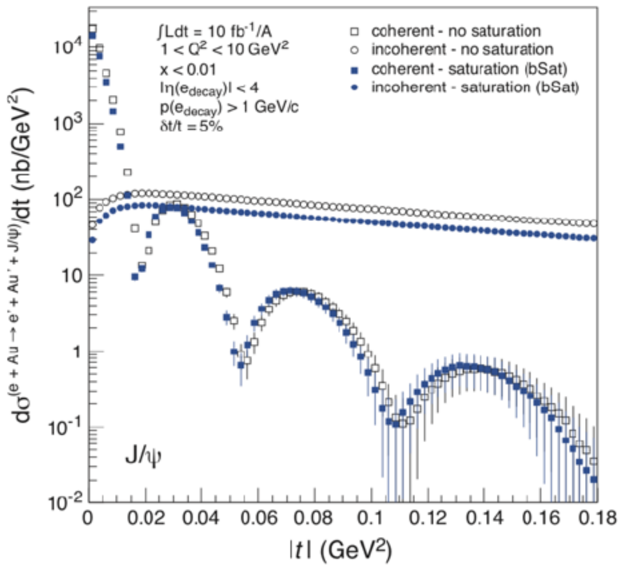
- Dual-radiator RICH n hadron endcap gives excellent hadron and electron ID
  - CORE solenoid is optimized for a high central field but a low field in the RICH.
- High-resolution Hcal in hadron endcap (yellow)
  - Important for high-x jets, J-B method for reconstruction of event kinematics, etc.
- Low-resolution Hcal with emphasis on excellent muon ID in barrel and electron endcap
  - *Cf.* Belle II KLM

IR integration



IR8 layout

Diffraction on nuclei (YR)



- CORE itself is compatible with both the IP6 (STAR) and IP8 (PHENIX) locations and all proposed IR layouts.
- An IR with a large, flat dispersion coinciding with an x-y focus (currently IR8) is preferred as it offers important physics capabilities:
  - Improved low-p_T acceptance for protons and light ions at low- and medium x.
  - Clean measurement of coherent diffraction on nuclei by tagging (vetoing) of the A-1 system
  - Measurement of the level structure of short-lived rare isotopes (complementary to FRIB)

Physics working groups – timeline and goals

- Proposal deadline is December 1, 2021.
  - Detector will need to be “frozen” by early October at the latest
  - After that, physics simulations can only be used to sharpen the narrative

- The proposal will only have 40 pages for detector and physics
  - Only a few pages per topic! Physics studies will need to be selective.

- The main goal is to show that CORE satisfies the requirements of the EIC physics program (e.g., Yellow Report, White Paper, etc)
  - Simulation of a few key channels within each broad topic including detector effects (and possibly backgrounds)

- Also important to illustrate opportunities created by CORE – either separately or in combination with the forward detection in the IR8 layout
  - Example: DVCS on nuclei

Physics working groups – best path forward?

- As WG conveners, feel free to involve anyone you think would be interested and could contribute!

- Common simulation tools will be provided!
  - Delphes (fast MC) and, at a later stage, Fun4All (Geant)

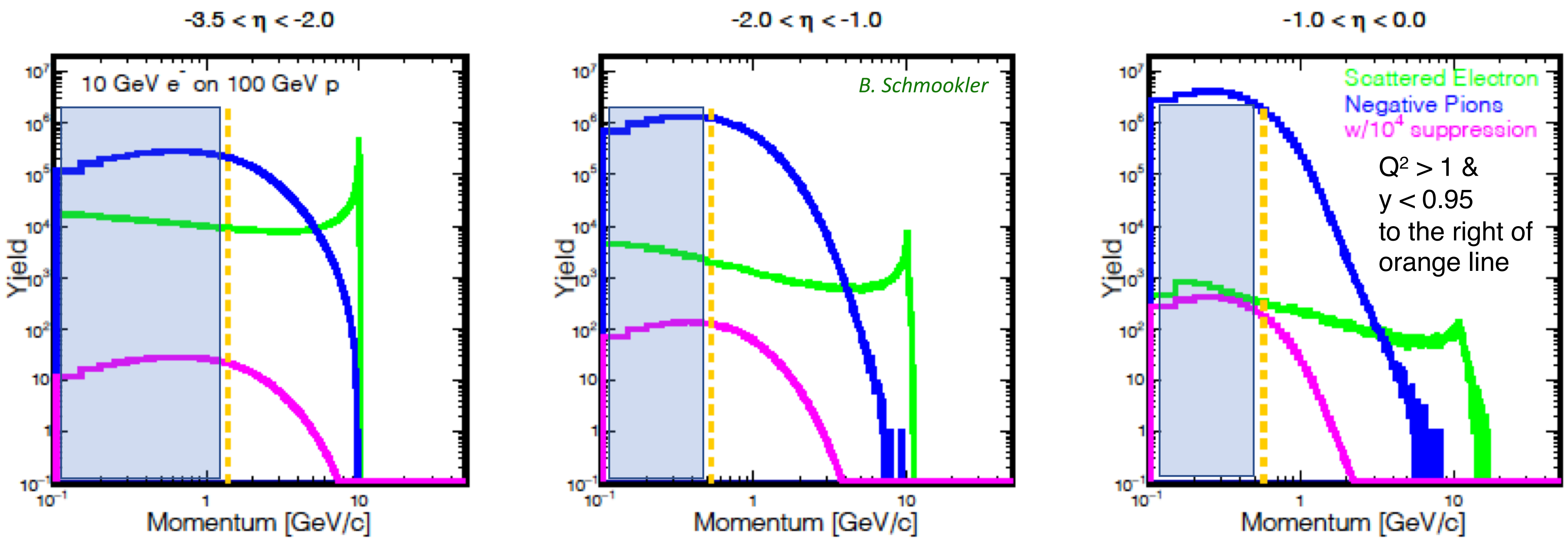
- Important to collaborate between WGs to reduce duplication of effort and maximize synergies
  - E.g., electron detection will be common to all!.

- How do we best organize the WG activities?
  - Collaboration between WGs – occasional common meetings?
  - Integration of WG activities with other ongoing CORE efforts?

Thank you!

e/π identification in the electron hemisphere

$\eta = -\ln(\tan(\theta/2))$



- For the EIC, a clean identification of the scattered electron is essential.
- The barrel region poses the greatest challenge and requires the best electron ID.
- CORE addresses this issue by extending the PWO EMcal coverage up to $\eta < 0$ (or possibly -0.5)
- Additional e/π suppression (at least 1:10 up to 1.2 GeV) is also provided by the DIRC.